

## REMARKS

This Amendment is submitted in response to a non-final Office Action mailed on May 14, 2009. Claims 11-23 are currently pending and stand rejected under 35 U.S.C. § 103(a). In response, Applicants have amended claim 11. No new material has been added by way of this amendment. Applicants assert that the rejections are moot in view of this amendment. Applicants also acknowledge the double patenting rejection issued in view of App. No. 10/536,934 is no longer provisional because that application has now been granted and issued as U.S. 7,511,402. Applicants submit herewith a Terminal Disclaimer to overcome that double patenting rejection.

As a preliminary matter, Applicants previously received an interview summary from the Patent Office for an interview that was not conducted and was apparently misidentified as being associated with this application. Applicants have mentioned this error in an informal telephone call to the Examiner. While the application number and applicants on the sheet are connected to this application, the Examiner, Sheela Rao, and the Art Unit, 2123, are connected to another case. The Examiner in this case indicated that a correction would be made, but for completeness, the Applicants include a copy of that interview summary.

Applicants' gratefully acknowledge and thank Examiner Hobbs for taking the time to conduct the Telephonic Interview on August 10, 2009. During that interview, the mechanism of action for the actuators of the claimed invention was compared to that of the prior art, particularly with respect to occlusion and release of hydrogen in the catalytic systems. The arguments made herein will reflect that discussion.

In the Office Action, claims 11-20 are rejected under §103(a) as being unpatentable over U.S. Patent No. 5,250,167 to Adolf et al. ("Adolf"), in view of Hirai et al. ((2003) Proc. of SPIE 5051: 198-206), U.S. Patent No. 6,249,076 to Madden et al. ("Madden"), and U.S. Patent No. 6,475,637 to Shahinpoor et al. ("Shahinpoor"). In response, Applicants have amended claim 11 to incorporate the limitation that the pH change in the polymer gel is achieved without the evolution of gas and the consumption of water. Support for the claim amendments can be found throughout the specification, and at least at pages 8 and 11 of the Applicants' filed application. As Applicants have discussed, the claimed invention occludes and releases hydrogen from the electrode buried within the gel electrode complex. The release or occlusion of that hydrogen ion

changes the pH of the gel in the gel/electrode complex, causing the gel to expand or contract and thereby accomplish work. The pH change of the gel electrode complex does not rely on the electrolysis of water and avoids the evolution of gases (i.e. oxygen or hydrogen.)

In contrast, the prior art does not teach or suggest a gel/electrode complex that occludes and releases hydrogen from the electrodes. Instead, the prior art references cited by the Patent Office either relies on electrolysis of water to effect a change in any gel complex, or does not effect a change in pH at all. Electrolysis of water leads to consumption of the water and evolution of gas – problems which the current invention specifically overcomes. Specifically, Adolf does not teach occlusion and release of hydrogen that changes the pH. Adolf relies on establishing a pH gradient at the two separate electrodes, and specifically refers to the devices as electrolysis cells. Hirai does not rely on pH change at all, but instead on electric field induced deformations. Madden does not rely on pH change either, but instead relies of electrical deformation. Shahinpoor merely measures or effects mechanical deformation using electrical field induced deformations. None of these references describes a pH changed effected by occlusion and release of hydrogen from an electrode. Because none of the references supplies this limitation to the claim, the combination of references does not render the claimed invention obvious.

Moreover, none of the references teaches or suggests that the mechanism of action can be achieved without the consumption of water or the formation of gases, as required by the amended claims. Only Adolf and Hirai are even relevant for this limitation, and both teach away from it. Adolf makes clear that the cells created in its systems are electrolysis cells, which rely on the electrolysis of water to produce pH imbalances and will generate gases of oxygen and hydrogen. See, for example, col. 1 ln. 66 to col. 2 ln. 26; col. 5 ln. 60-65; col. 7 ln. 41-43. Hirai states the problems in a more overarching fashion when discussing problems that plague gel electrodes in the prior art. Hirai notes in its Introduction that polymer gels and materials swollen with solvent and controlling the gel volume through composition, pH, ionic strength, etc. – conditions which would be applicable to the current invention. However, in the next paragraph, Hirai notes that swollen gels are inconvenient in practical use because they are hampered by diffusion limitations, and deformation without diffusion is desirable. Furthermore, Hirai notes that “deformation processes are electrochemical reactions on the electrodes, which are

irreversible chemical processes or chemical consumption that limit the life span of the materials." (emphasis added.) In contrast to the clear disclosure of Hirai and Adolf, Applicants have provided an actuator that achieves work by occlusion and release of hydrogen from the electrode, without the consumption of water or the production of gas. Therefore, Applicants respectfully assert that the claimed invention is non-obvious over the cited references.

For at least the reasons above and as previously discussed in the Response to non-final Office Action filed February 17, 2009, Applicants respectfully request withdrawal of the 35 U.S.C. §103(a) rejections of Claims 11-23. Accordingly, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicit reconsideration of same. The Commissioner is hereby authorized to charge deposit account 02-1818 for any fees which are due and owing.

Respectfully submitted,

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Dated: August 14, 2009

<b>Interview Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/598,958	ITO ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Sheela Rao	2123	

All participants (applicant, applicant's representative, PTO personnel):

(1) Sheela Rao. (3) \_\_\_\_\_

(2) Richard Chang. (4) \_\_\_\_\_

Date of Interview: 30 June 2009.

Type: a) ☒ Telephonic b) ☐ Video Conference  
c) ☐ Personal [copy given to: 1) ☐ applicant 2) ☐ applicant's representative]

Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No.

If Yes, brief description: \_\_\_\_\_

Claim(s) discussed: 1 and 15.

Identification of prior art discussed: US Patent Application Publication No. US 2004/0139084 A1 to Markow, US Patent Application Publication No. US 2008/0300828 A1 to Kojima and US Patent Application Publication No. US 2007/0049439 A1 to Garnett.

Agreement with respect to the claims f) ☐ was reached. g) ☒ was not reached. h) ☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: The references of prior art in view of the claim limitations were discussed. Applicant's representative believes that none of the references teach the elements of the instant claims, but Examiner disagrees. As stated in the current Office action, the limitations of the invention are clearly outlined as being taught by the prior arts. Upon submission of Applicant's response, the rejections over the prior arts will be reviewed and reconsidered.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/Kidest Bahta/  
Primary Examiner, Art Unit 2123